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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/898,815	07/05/2001	Shi-Chang Woolh	MIT-114J	3226
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Iandiorio & Teska 260 Bear Hill Road Waltham, MA 02451-1018				
EXAMINER YAM, STEPHEN K				
ART UNIT 2878		PAPER NUMBER		

DATE MAILED: 10/15/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/898,815

Applicant(s)

WOOH, SHI-CHANG

Examiner

Stephen Yam

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-- Th MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 2 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- ☐ Responsive to communication(s) filed on 21 August 2003.
- ☐ This action is **FINAL**. ☒ This action is non-final.
- ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- ☒ Claim(s) 1-19 is/are pending in the application.
 - Of the above claim(s) _____ is/are withdrawn from consideration.
- ☐ Claim(s) _____ is/are allowed.
- ☒ Claim(s) 1-19 is/are rejected.
- ☐ Claim(s) _____ is/are objected to.
- ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- ☐ The specification is objected to by the Examiner.
- ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - All
 - Some *
 - None of:
 - Certified copies of the priority documents have been received.
 - Certified copies of the priority documents have been received in Application No. _____.
 - Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.
- ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
 - The translation of the foreign language provisional application has been received.
- ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 0903
- ☐ Interview Summary (PTO-413) Paper No(s) _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other:

DETAILED ACTION

This action is in response to Amendments and remarks filed on August 21, 2003. Claims 1-19 are currently pending.

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 21, 2003 has been entered.

Information Disclosure Statement

2. The information disclosure statement filed August 21, 2003 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each U.S. and foreign patent, each publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered. A copy of the publication "Laser-Ultrasonics: Techniques and Applications" by C.B. Scruby and L.E. Drain has not been included.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Drescher-Krasicka US Patent No. 5,549,003 in view of Schultz et al. US Patent No. 5,286,313.

Regarding Claim 1, Drescher-Krasicka teaches a defect detection system comprising (see Fig. 6a) an excitation laser system (22) (see Col. 2, lines 59-63) for projecting a laser beam at the near surface of a sample (24 in Fig. 6a, 42 in Fig. 6d) to be tested for generating acoustic longitudinal (56) (see Fig. 6d), surface Rayleigh (54), and shear (58) waves, a detection laser system (40) spaced from said excitation laser to intercept shear waves reflected from the far surface of the sample, and a detection circuit (62) for detecting the energy level of the reflected shear wave intercepted by said detection laser system representative of a flaw in the sample. Regarding Claim 2, Drescher-Krasicka teaches (see Fig. 6d) the excitation laser system and detection laser system on the same side of the sample. Regarding Claim 3, Drescher-Krasicka teaches a movable support (60) for said excitation laser system and detection laser system for moving them along the sample. Regarding Claim 4, Drescher-Krasicka teaches the detection circuit including a shear wave sensing circuit (see Fig. 6a) for sensing the energy level (see Col. 12, lines 3-7) of the reflected shear waves and the time of arrival (see Col. 11, line 66 to Col. 12, line 3) of the reflected shear wave at the detection laser system. Regarding Claim 5, Drescher-Krasicka teaches the detection circuit including a first logic circuit for recognizing the presence of a potential flaw if the energy level of the reflected shear waves sensed by the shear wave sensing circuit is less than a predetermined level (see Col. 12, lines 7-12). Regarding Claim 6, Drescher-Krasicka teaches the detection circuit (40) (see Fig. 6d) including a surface Rayleigh

wave sensing circuit for sensing the energy level (see Col. 17, lines 33-36) and time arrival (see Col. 7, lines 10-11) of the surface Rayleigh wave. Regarding Claim 8, Drescher-Krasicka teaches the detection circuit including a scanning device for sensing the variation in the energy level of the reflected shear wave along the sample to create shadows of a flaw (see Col. 12, lines 19-22). Regarding Claim 9, Drescher-Krasicka teaches a measuring circuit for measuring the length of each shadow cast by a flaw blocking shear wave propagation and the distance between those shadows (shown on screen as "black/gray pixels"- see Col. 12, lines 10-22). Regarding Claim 10, Drescher-Krasicka teaches (see Fig. 6d) a positioning circuit (64) for determining the location, size, and orientation of a flaw. Regarding Claim 12, Drescher-Krasicka teaches (see Fig. 6d) a method of detecting a defect in a sample (42) comprising photoacoustically exciting acoustic longitudinal (56), surface Rayleigh (54), and shear (58) waves with an excitation laser beam at a first point on the near surface of the sample, photoacoustically detecting (40) acoustic waves at a second point spaced from the excitation first point for intercepting shear waves reflected from the far surface of the sample, and detecting (62) the energy level of the intercepted reflected shear wave representations of a flaw in the sample. Regarding Claim 13, Drescher-Krasicka teaches the excitation and detection occurring on the same side of the sample (see Fig. 6d). Regarding Claim 14, Drescher-Krasicka teaches (see Fig. 6d) the excitation and detection points moved (60) along the sample. Regarding Claim 15, Drescher-Krasicka teaches sensing the energy level of the reflected shear wave and recognizing the presence of a potential flaw if the energy level is below a predetermined level (see Col. 12, lines 7-12). Regarding Claim 17, Drescher-Krasicka teaches determining the variation in energy level of the reflected shear wave along the sample to create shadows of the flaw (see Col. 12, lines 19-22). Regarding Claim 18,

Drescher-Krasicka teaches measuring the length of each shadow cast by the flaw (shown on screen as "pixels"- see Col. 12, lines 10-22). Regarding Claim 19, Drescher-Krasicka teaches (see Fig. 6d) determining (64) the location, size, and orientation of a flaw from the size and separation of the shadows. Drescher-Krasicka do not teach the detection laser system for projecting a laser beam and intercepting the shear waves at approximately the angle of maximum shear wave propagation and minimizing interference with longitudinal and surface Rayleigh waves. Schultz et al. teach (see Fig. 2a-2c and 3) a detection system comprising an excitation laser system (24) for projecting a laser beam (35) at the near surface of a sample (23) to be tested for generating acoustic longitudinal, surface Rayleigh, and shear waves (see Col. 2, line 65 to Col. 3, line 4 and Col. 4, lines 43-47 and Col. 12, lines 3-5) in the sample, a detection laser system (40) spaced (at a distance X) from said excitation laser for projecting a laser beam (41) and to intercept shear waves reflected from the far surface of the sample (see Col. 22, lines 25-34) at approximately the angle of maximum shear wave propagation (by optimizing distance X according to multiple factors- see Col. 13, lines 22-25) and minimize interference with longitudinal and surface Rayleigh waves (since each wave is measured separately through wave time/velocity and shear waves are separated out- see Col. 22, lines 18-34), and a detection circuit (45) for detecting the energy level of the reflected shear wave intercepted by said detection laser system. It would have been obvious to one of ordinary skill in the art at the time the invention was made to project a laser beam in the detection laser system at approximately the angle of maximum shear wave propagation and minimize interference with longitudinal and surface Rayleigh waves as taught by Schultz et al. in the system of Drescher-Krasicka, to provide increased sensitivity to the acoustic waves to improve flaw detection.

Regarding Claim 7, Drescher-Krasicka in view of Schultz et al. teach the system in Claim 6, according to the appropriate paragraph above. Drescher-Krasicka does not teach a second logic circuit for inhibiting recognition of a potential flaw if the energy level of the surface Rayleigh wave sensing circuit is less than a predetermined level. It is well known that a lack of surface Rayleigh waves indicates a rough sample surface, as the surface and shear waves would scatter along the ridges of the surface and not reflect towards the detection circuit. It would have been obvious to one of ordinary skill in the art at the time the invention was made to include a second logic circuit for inhibiting recognition of a potential flaw according to a predetermined energy level of the surface Rayleigh waves in the defect detection circuit of Drescher-Krasicka in view of Schultz et al., to recognize an uneven sample surface and prevent a false positive reading of a potential flaw that occurs when shear waves are not fully detected by the detection circuit.

Regarding Claim 11, Drescher-Krasicka in view of Schultz et al. teach the system in Claim 1, according to the appropriate paragraph above. Drescher-Krasicka also teaches the defect detection system with the sample including steel (see Col. 7, lines 38-41). Drescher-Krasicka does not teach the angle of maximum shear wave propagation being approximately 40° . Schultz et al. teach the angle of maximum shear wave propagation dependent on multiple variables including the thickness of the sample, laser intensity, etc. (see Col. 13, lines 21-26). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use an angle of approximately 40° in the system of Drescher-Krasicka in view of Schultz et al., to establish optimal acoustic propagation for a certain sample thickness and laser intensity.

Regarding Claim 16, Drescher-Krasicka in view of Schultz et al. teach the method in Claim 12, according to the appropriate paragraph above. Drescher-Krasicka does not teach

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sensing the energy level of the surface Rayleigh waves and inhibiting detection of a flaw if that level is below a predetermined level and confirming recognition if it is greater than the predetermined level. It is well known that a lack of surface Rayleigh waves indicates a rough sample surface, as the surface and shear waves would scatter along the ridges of the surface and not reflect towards the detection circuit. It would have been obvious to one of ordinary skill in the art at the time the invention was made to sense the surface Rayleigh waves to inhibit flaw detection according to a predetermined energy level in the defect detection method of Drescher-Krasicka in view of Schultz et al., to recognize an uneven sample surface and prevent a false positive reading of a potential flaw that occurs when shear waves are not fully detected by the detection circuit.

Response to Arguments

5. Applicant's arguments with respect to claims 1-19 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Lorraine et al. US Patent No. 5,760,904, teach a detection system using a source laser, detection laser, and detection circuit to detect defects.

Kotidis et al. US Patent No. 5,604,592, teach a defect detection system using a source laser to emit longitudinal, shear, and Rayleigh waves and a detection laser to detect the propagation time of the shear wave through a sample.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen Yam whose telephone number is (703)306-3441. The examiner can normally be reached on Monday-Friday 8:30am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Porta can be reached on (703)308-4852. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

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